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Surveys for the Pacific Sheath-tailed Bat in American Samoa

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ABSTRACT

Because bats are often the only native terrestrial mammals on geographically isolated island systems, they are critical to the biodiversity of mammalian fauna. *Emballonura semicaudata* was once widespread and relatively common throughout its historic range in Micronesia and Polynesia, however, drastic declines and possible extinctions on some islands have been recorded in recent years. The objectives of the Pacific sheath-tailed bat inventory were to determine and document: (1) the occurrence of Pacific sheath-tailed bats in parks and selected areas of American Samoa; and (2) general habitat characteristics associated with Pacific sheath-tailed bat observations. Acoustic surveys were done in 2006 using Mini-3 bat detectors, while surveys in 2008 were done using Anabat II frequency division bat detectors. Literature reviews, interviews with local residents and park personnel, and discussions with other scientists working with insectivorous bats were also conducted to investigate possible locations of Pacific sheath-tailed bats in sample areas. Because *E. semicaudata* is rare in our survey areas, this inventory was highly exploratory and opportunistic in nature. Although we did not detect any Pacific sheath-tailed bats in American Samoa during acoustic surveys in 2006 and 2008, it is possible that these bats have moved into more remote areas of the islands. Future surveys should focus on use of passive monitoring bat detectors (e.g., Anabat detection systems), which allows for continued, long-term monitoring in the absence of researchers, while operating for long time periods on battery power. We also recommend additional interviews with residents, as well as thorough searches in remote areas of Ta'u, Tutuila, and Ofu/Olosega, particularly focusing on areas where sheath-tailed bats have been previously reported.

INTRODUCTION

As one of only a few native terrestrial mammals found on the geographically isolated islands of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI), Pacific sheath-tailed bats *(Emballonura semicaudata*) are a critical component of mammalian fauna biodiversity. *E. semicaudata* was once widespread and relatively common throughout its historic range in Micronesia and Polynesia. However, drastic declines and possible extinctions on some islands have been recorded over the last 20 years (Hutson et al. 2001). On Guam the disappearance of Pacific sheath-tailed bats has been largely attributed to degradation of cave habitats caused during WWII, use of pesticides (Hutson et al. 2001), and catastrophic tropical storms (Grant et al. 1994). Furthermore, the introduction of the brown tree snake (*Boiga irregularis*) on Guam (Wiles et al. 1995) may have also devastated the Pacific sheath-tailed bats. Although the last known sighting of a Pacific sheath-tailed bat on Guam occurred in May, 1972 (Kami et al. 1976), it was not until 1981 that the Acting Governor of Guam petitioned the U.S. Fish and Wildlife Service (USFWS) to place them on the U.S. List of Endangered and Threatened Wildlife. Due to a lack of information regarding presence and distribution, the petition was denied (Lemke 1986). However, the USFWS finally classified *E. semicaudata* as a candidate for listing with a priority number of 3 (Center for Biological Diversity 2004). Likewise, populations of *E. semicaudata* in American Samoa have also declined at an alarming rate, dropping from estimates in the thousands during the 1970s to possibly only a few individuals in the 1990s (Grant et al. 1994). It may be that Pacific sheath-tailed bats have already been extirpated from American Samoa (Grant et al. 1994). Nevertheless, searches in remote areas of the islands may yield new roosting information and should be explored (G. J. Wiles, pers. comm., Washington Department of Fish and Wildlife). At present, Pacific sheath tailed bats are known to occur on Aguiguan, Commonwealth of the Northern Mariana Islands (Esselstyn et al. 2004), and conceivably in areas of Tinian, CNMI (G.J. Wiles, pers. comm., Washington Department of Fish and Wildlife), western Samoa (Tarburton 2002), and Tutuila, American Samoa (Hutson et al. 2001, Center for Biological Diversity 2004). Surveys for Pacific sheath-tailed bats in both volcanic and limestone caves and bluffs and surrounding forests in selected areas of American Samoa are necessary before monitoring or conservation strategies can be developed for this species. Approaches developed for the Pacific sheath-tailed bat may also benefit other cave dwelling species, such as cave swiftlets (*Collocalia* spp.) and various invertebrates (Hutson et al. 2001).

Although *E. semicaudata* is extant, it is extremely rare in our survey areas. Select areas of American Samoa in and within proximity to units of the National Park of American Samoa (NPSA) on Ta'u, Ofu, and Tutuila were identified for inventory of Pacific sheath-tailed bats. Inventory methods similar to those used for hoary bat (*Lasiurus cinereus semotus*) inventories in national parks in the Hawaiian Islands were implemented to determine and document: (1) the occurrence of Pacific sheath-tailed bats in parks and selected areas of American Samoa; and (2) general habitat characteristics associated with Pacific sheath-tailed bat observations.

METHODS

We surveyed for Pacific sheath-tailed bats in 2006 and 2008. This inventory included national park lands with potential habitat (i.e., caves and forested areas near caves), as well as areas of American Samoa where sightings had been previously documented. Survey methods, although similar in function and final output, differed in each year, as different types of acoustic equipment were available for use. Surveys in 2006 were conducted using Mini-3 bat detectors (Ultra Sound Advice, United Kingdom), which require the user to "tune" a dial on the device to the desired frequency for detection. This method is limited, as it only picks up bats echolocating at a particular tuned frequency. Surveys in 2008 were done using frequency division bat detectors (Anabat II, Titley Electronics, NSW Australia), which may be better suited for field surveys of rare bats, as they pick up a wide range of ultrasounds. This means that the observer is more likely to observe bats echolocating at an unexpected frequency. Regardless of the equipment being used, acoustic detectors provide valuable information on: (1) the presence or absence of echolocating bats, and (2) the presence or absence of feeding activity (i.e., detection of feeding buzzes vs. search/contact calls). In turn, this provides information on foraging areas.

Between 8 May and 18 May 2006, we surveyed at both sunset and sunrise (Table 1), while driving or walking along easily accessible roads and trails on the islands of Tutuila (Figure 1), Ta'u (Figure 2), Ofu (Figure 3), and Olosega (Figure 3). An investigation of possible locations of Pacific sheath-tailed bats in sample areas was conducted through literature reviews, interviews with local residents and park personnel, and discussions with other scientists working with insectivorous bats. Because *E. semicaudata* is rare in our survey areas, this inventory was highly exploratory and opportunistic in nature. Although we visually inspected the sky at sunset and sunrise for observations of foraging bats, we focused primarily on the use of acoustic bat detectors (Mini-3 bat detector, Ultra Sound Advice, U.K.). Detectors were tuned to 30 kHz, which was determined to be the most appropriate frequency for detecting Pacific sheath-tailed bats under a variety of circumstances (Esselstyn et al. 2004). During driving surveys, one or two detectors were held outside of the open vehicle window. Surveys were also conducted while sitting in open areas at specific point locations with one or two detectors pointed up to the sky.

Table 1. Dates, times, and locations of *E. semicaudata* surveys on the islands of Tutuila, Ta'u, Ofu, and Olosega during 2006.

Date	Island	Start Time	End Time	Total Survey Time (min)	# Detectors Used	Combined Survey Effort (survey time x # detectors)	Waypoint	Survey Track
5/8/2006	Tutuila	2140	2225	45	2	90	84	
5/8/2006	Tutuila	2233	2248	15	2	30	85	
5/8/2006	Tutuila	2300	2315	15	2	30	86	
5/9/2006	Tutuila	1826	2046	120	2	240	88	
5/11/2006	Tutuila	535	615	40	1	40	90	
5/11/2006	Tutuila	550	620	30	1	30	91	
5/11/2006	Ta'u	1745	1815	30	1	30	93	
5/12/2006	Ta'u	605	645	40	1	40	94, 95, 96	Fitiuta to WP 94 to WP 95 to WP 96
5/12/2006	Ta'u	1805	1857	52	1	52		Fitiuta to Ta'u Village
5/13/2006	Ta'u	600	645	45	2	90		Fitiuta to Siu Point
5/13/2006	Ofu	1643	1915	152	2	304	105, 106, 107	WP 105 to WP 106 to WP 107 to end of road past Olosega
5/14/2006	Ofu	600	645	45	2	90	109	
5/14/2006	Ofu	1730	1835	65	2	130	109	
5/15/2006	Olosega	615	645	30	2	60	110	
5/15/2006	Ofu/Olosega	1740	1830	50	2	100		WP 105 to Sili Village and back
5/16/2006	Ofu	615	645	30	2	60	109	
5/17/2006	Tutuila	550	640	50	2	100	112	Pago to Fagasa (WP 112)
5/18/2006	Tutuila	610	640	30	2	60		Pago to Utumea

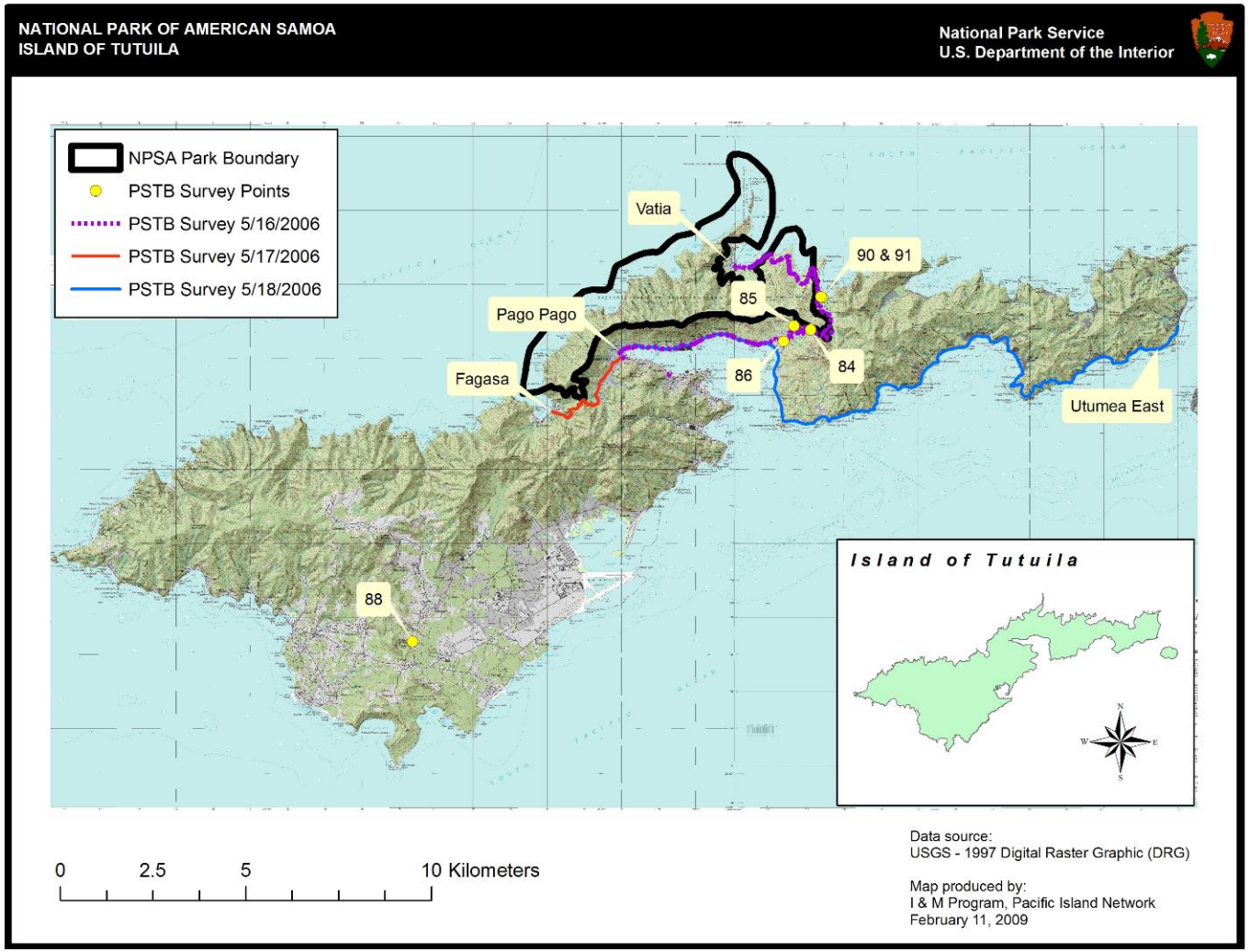

Figure 1. Survey locations for Pacific sheath-tailed bats on the island of Tutuila, American Samoa. Surveys were conducted on this island from May 8-11 and May 16-18, 2006.

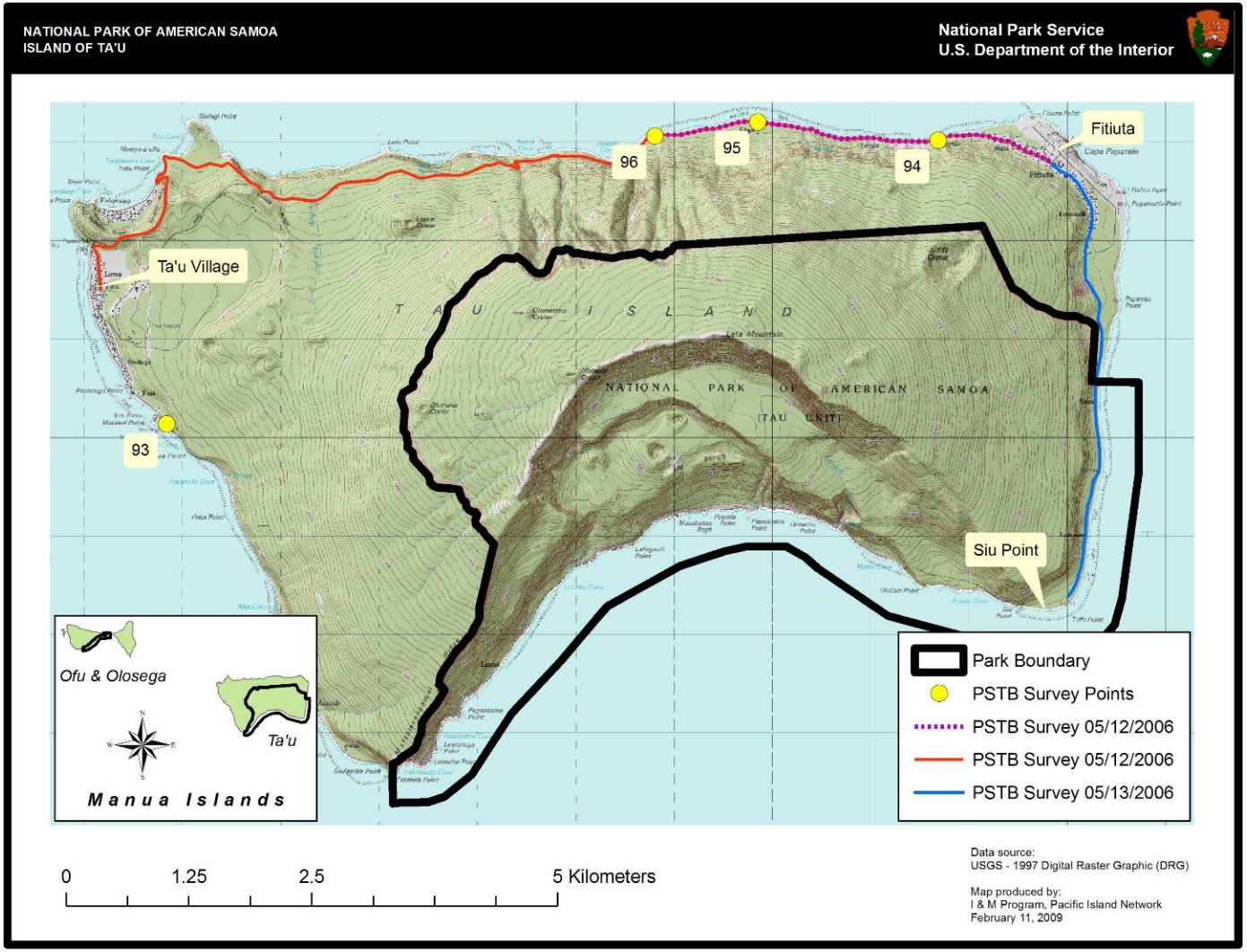

Figure 2. Survey locations for Pacific sheath-tailed bats on the island of Ta'u, American Samoa. Surveys were conducted on this island from May 11-13, 2006

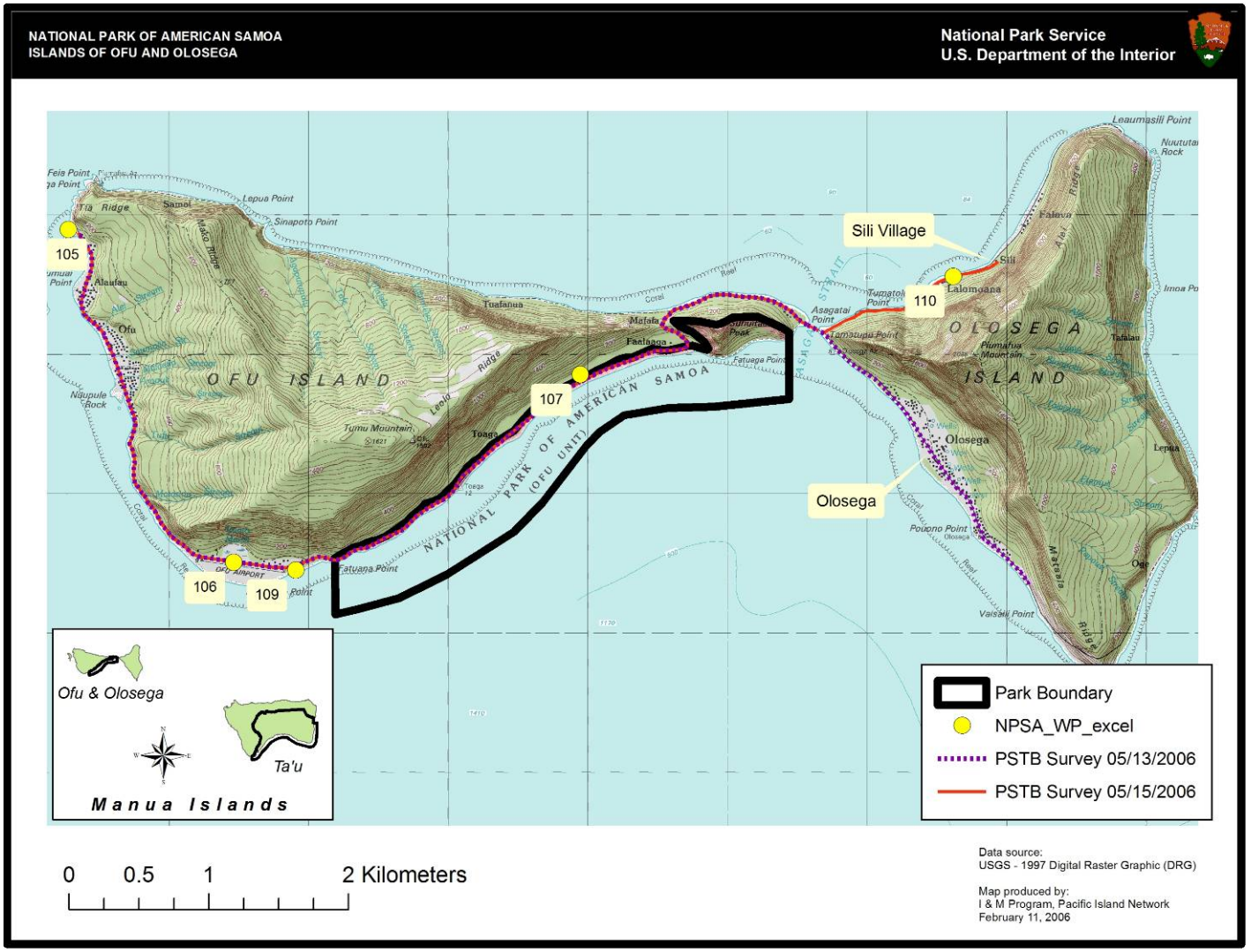

Figure 3. Survey locations for Pacific sheath-tailed bats on the islands of Ofu and Olosega, American Samoa. Surveys were conducted on these islands May 13-16, 2006.

Surveys occurring between 11 February and 16 February 2008, were done while driving along roads on Tutuila Island (Table 2). Surveys were conducted for approximately 2 hours, beginning at sunset. We attempted to cover most of the accessible roads on the island during the 6 nights of sampling (Figure 4). Additionally, we opportunistically searched for *E. semicaudata* at night using both bat detectors and a thermal imaging camera in Pago Pago and areas of the National Park of American Samoa (Mt. Alava Trail, Sauma Ridge). Two bat detectors were held facing out opened windows on both sides of the field vehicle.

Table 2. Dates, times and locations of *E. semicaudata* surveys on the island of Tutuila during 2008.

Date	Start Time	End Time	Total Survey Time (min)	# Detectors Used	Combined Survey Effort (survey time x # detectors)	Distance Travelled (km)	Survey Track
2/11/2008	18:30	20:30	120	2	240	16	Pago Pago to Sauma Ridge Fale
2/12/2008	18:50	21:00	130	2	260	56	Pago Pago to East Side
2/13/2008	18:45	21:20	155	2	310	42	Pago Pago to Tafuna
2/14/2008	18:45	21:00	135	2	270	11	Pago Pago to Fagasa
2/15/2008	19:00	21:00	120	2	240	22	Pago Pago to Vatia
2/16/2008	19:00	21:30	150	2	300	42	Pago Pago to West Side

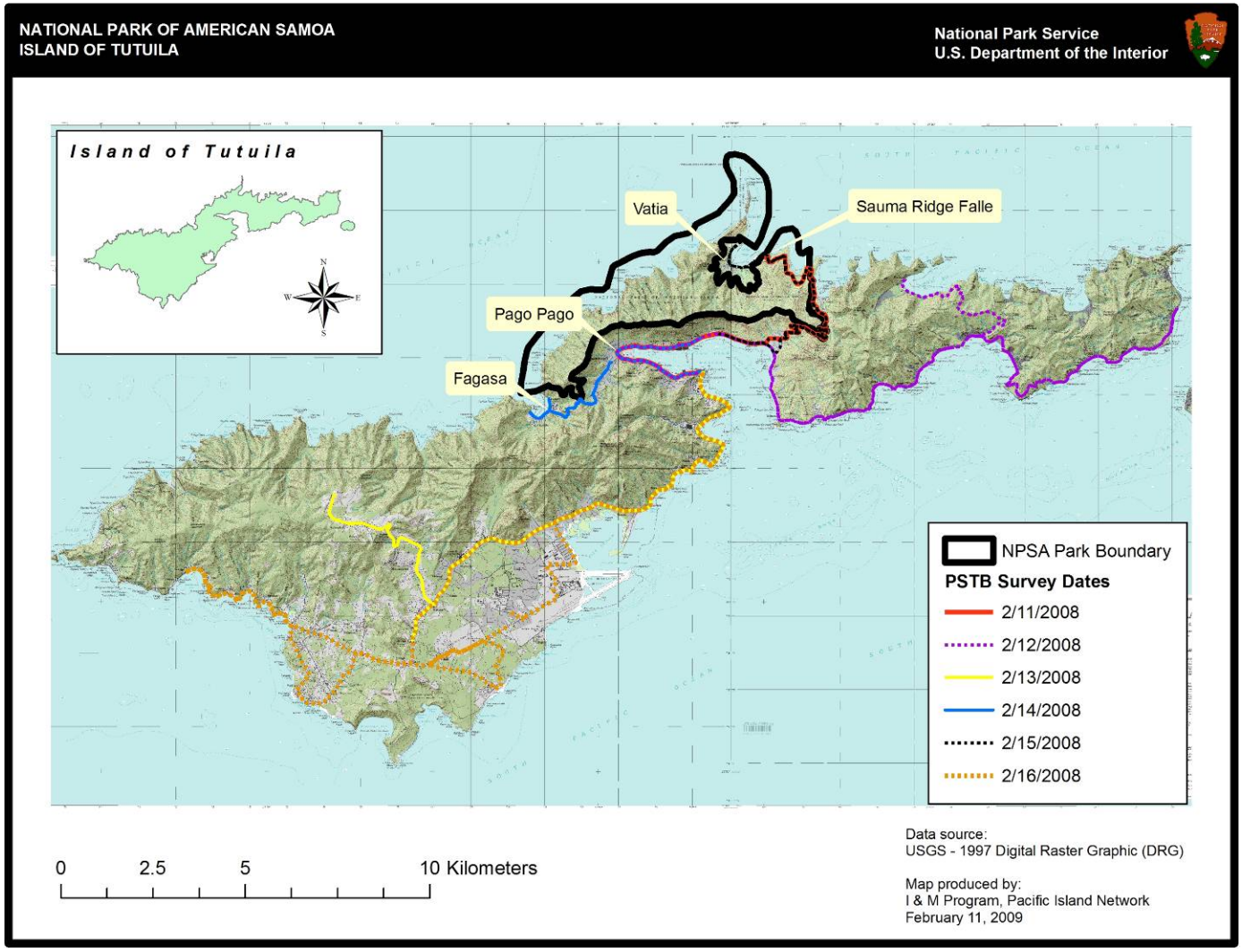

Figure 4. Survey locations for Pacific sheath-tailed bats on the island of Tutuila, American Samoa, from February 11-16, 2008.

RESULTS AND CONCLUSIONS

We did not detect any Pacific sheath-tailed bats in American Samoa during acoustic surveys in 2006 and 2008, nor did we observe any insectivorous bats visually. Surveys during 2006 included a combined survey effort of 12.5 hours on Tutuila, 3.53 hours on Ta'u, and 12.4 hours on Ofu/Olosega. During surveys in 2008, a total of 27 survey hours (13.5 hours * 2 observers) were conducted driving approximately 189 km.

Although we did not visually and/or acoustically detect Pacific sheath-tailed bats in American Samoa, our survey efforts were limited by time, travel, and equipment constraints. It is possible that these bats have moved into more remote areas of the islands (G.J. Wiles, pers. comm., Washington Department of Fish and Wildlife). Therefore, future surveys should focus on use of passive monitoring bat detectors (e.g., Anabat detection systems). This type of detector allows for continued, long-term monitoring of specific site locations in the absence of researchers, and operates for long time periods on battery power. In turn, this increases the chance of detecting rare bats, as the equipment remains stationary. We also recommend that remote areas of Ta'u, Tutuila, and Ofu/Olosega be thoroughly investigated, particularly focusing on areas with reported caves, in addition to further interviews with residents to evaluate potential cave sites.

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